Smart Rain Water Harvesting System (SRWHS) Using IoT Enabled Smart Kit for Better Tracking and Management in Pune City

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Abstract— Rain water harvesting is receiving increased attention worldwide as an alternative source of water especially in drought affected area. India is lucky to be in the tropical monsoon zone and it receives plenty of rainfall during the monsoon season every year. Though the Monsoon brings plenty of water with adequate rainfall as a whole, yet there are large swathes of dry and drought prone areas in the country. Also in many places the quality of groundwater is not good. Some areas having quite even rainfall but there is also problem of a severe scarcity of drinking water. This is because we have rainfall in short spells of high intensity.

Due to this intensity and short duration of heavy rain, most of the rain falling on surface tends to flow away rapidly and leaving very little for the recharge of ground. Therefore, it is necessary to collect and store rainwater. The present study has been undertaken to assess the potential of and Rain Water and Rain Water Harvesting (RWH) technique in the sustainable development of water resources of Pune city although our aim is to proposed Smart Rain Water Harvesting System (SRWHS) Using IoT Enabled Smart Kit for Better Tracking and Management of RWH in Pune City.

The research study is being undertaken to understand the existing RWH system in the Pune city. There is a need of SRWHS but it is also required to consider its potential benefits, challenges, development and effective implementation in the city.

This research research paper highlights the existing RWH system and the proposed design for SRWHS using IoT Enabled Smart Kit and Data Analytics for better monitoring and management of the system.

Keywords— Rain Water Harvesting, IoT, Smart Kit, Big Data, Big Data Analytics

I. INTRODUCTION

Water is a fundamental segment in each part of life and must be esteemed and shielded. It is the most significant assets for endurance of person as much as food, air and so forth, however not many considerations are paid for its practical use and protection of this valuable asset. Due to over siphoning of ground water, the water table is going down anomalous and on the off chance that the issue isn't given a genuine look, at that point the people in the future may need to confront serious shortage of water. Precipitation is the prime wellspring of water.

Like many other cities of India, in Maharashtra State, Pune city is blessed with plenty of rainfall. The only concern is to tap this valuable resource which pours in the form of rains during the rainy season. Despite its immense usefulness, we fail to conserve the most valuable resource. Rain Water Harvesting (RWH) is increasingly viewed as a major strategy for enhancing the present condition of water crises especially in the dry seasons. While RWH is being promoted and initiated by the Pune Municipal Corporation (PMC) and Pimpri-Chinchwad Municipal Corporation (PCMC) in Pune City as a compulsion to meet the daily requirement of water by the urban population of the city. The effective implementations and working of the systems is still a big challenge.

The purpose of the research study is to understand the existing RWH system in the Pune city and proposed a design for SRWHS using IoT Enabled Smart Kit and Data Analytics for better Monitoring and Management of the RWS systems in the Pune city. The paper also document its sustainability and effectiveness, for residential complexes in the city.

The research study being undertaken aims to validate the adoption of RWH technologies and its influence on self-sustainability of residential societies in Pune considering the need of the hour to meet the increasing requirement of the growing population. It will give us some insights regarding the potential of using SRWHS and their effect on the effectiveness improvement in coordinated urban water frameworks. The [1] has expressed that Strategic arranging of incorporated urban water frameworks needs to assess a mix of potential intercession alternatives to recognize the most fitting procedures which give long haul maintainability of these framework.With proper understanding of the existing system and research study, key performance indicators of the SRWHS will be recognized to accomplish the best operational presentation of the RWH framework in the city.

II. DEFINING: RAIN WATER HARVESTING (RWH)

Water reaping is the fate vital in the Socio-Economic improvement of the urban areas, where water sources are scant or dirtied.We, today wholly and solely depend upon the dams for our day to day water supply. Yes, the government has shouldered the responsibility by making necessary compliances for the builders who build the housing societies with regards to Rain Water Harvesting (RWH). Despite there being water scarcity in many parts of the city, citizens don’t seem keen to harvest rainwater. The city has saved only 12 million liters a day (MLD) of water through rainwater harvesting. This came to light from a study conducted by the Green Energy Foundation (GEF). But there still is space to augment the use of rain water through efficient conservation of rainwater through Rain Water Harvesting System (RHWS). Water shortage is one of the critical problems in Pune. This problem is not new one, and it cannot be solved overnight. The water table is lowering day by

day, and the recharge of groundwater table is facing difficulties because of the pavements and concrete roads. Water gathering is a powerful choice not exclusively to revive the groundwater spring yet additionally to give satisfactory capacity of water for sometime later.Certainly this reservoir of water underneath the ground could be of great use for flourishing days, as well critical period of the year. This system is a suitable sustainable option for providing water. It is almost the only way to upgrade one's community water supply. The installers of RWHS have installed the RWHS to meet the compliance put forth by the government for housing societies build up after 2008. But meeting this compliance will certainly help in reserving of the water table beneath the ground.

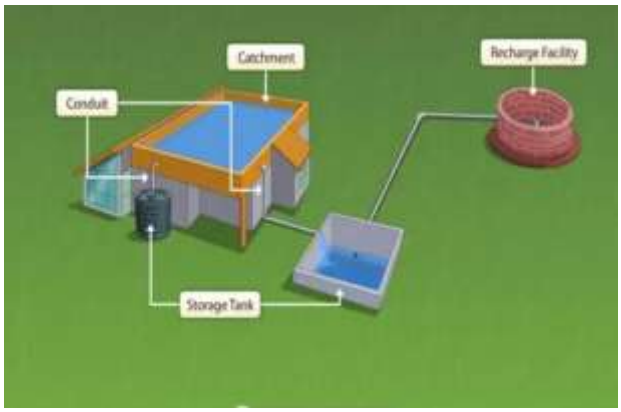

FIGURE 1: RAIN WATER HARVESTING SYSTEM (RWHS)

III. RWH SYSTEM AND BENEFITS

Downpour Water Harvesting is the assortment and capacity of water for reuse nearby, as opposed to permitting it to run off. These put away waters are utilized for different purposes.

- Precipitation is the principle wellspring of water which is to be protected for sometime later.
- Catchments: The catchment of a water reaping framework is the surface which legitimately gets the precipitation and gives water to the framework. It very well may be a cleared zone like a patio or yard of a structure, or an unpaved territory like a garden or open ground.
- Coarse work at the rooftop to forestall entry of trash.
- Conveyance frameworks (canals) to move the water from the rooftop or assortment surface to the capacity supply.
- First-flushing-A first flush gadget is a valve that guarantees that spillover from the main spell of downpour is flushed out and doesn't enter the framework. This should be done since the principal spell of downpour conveys a generally bigger measure of toxins from the air and catchment surface.
- The channel is utilized to expel suspended toxins from water gathered over rooftop. A channel unit is a chamber loaded up with sifting media, for example, fiber, coarse sand and rock layers to expel trash and soil from water before it enters the capacity tank or energizes structure. Charcoal can be added for. Additionally there are a wide variety of systems available for treating water either before, during and/or after storage (e.g. biosand filter, SODIS, chlorination; or in general HWTS).
- An extraction gadget (contingent upon the area of the tank) might be a tap, rope and can, or a siphon or an invasion gadget for the situation the gathered water is utilized for well or groundwater revive.
- Storage facility -There are various options available for the construction of these tanks with respect to the shape, size and the material of construction.
    - Shape: Cylindrical, rectangular and square.
    - Material of construction: Reinforced cement concrete, (RCC), Ferro cement, masonry, plastic (polyethylene) or metal (galvanized iron) sheets are commonly used.

Considering these benefits and many other related data which can be collected in different form either structured or unstructed and analyzed to understand the number of RWH projects have been sanctioned by the local government or municipal corporations, how many of them are successfully implemented and running as per the standard, how much water demand it has fullfilled and other such questions can be raised and observed during the reserach study like [2] has explained the big data has the potential to add value across all industry segments so like many other industry and goverment work this is one more area where government data can be analyzed and understand with respect to RWH systems and its impact on the human life as far as water availability, consumption, demand and supply is concerned and [3] has also highlighted that there are three fundamental divisions commanding the interest on water assets; these are predominantly the agrarian, modern, and residential areas.

IV. SMART RAIN WATER HARVESTING SYSTEM (SRWHS) USING IOT.

IoT refers to Internet of Things where various devices connect and interface with each other over Internet.Detecting gadgets gather and additionally create different tangible information after some time for a wide scope of fields and applications. These gadgets will bring about ongoing information streams. Applying investigation over such information streams can help find new data, anticipate future experiences, and settle on control choices.

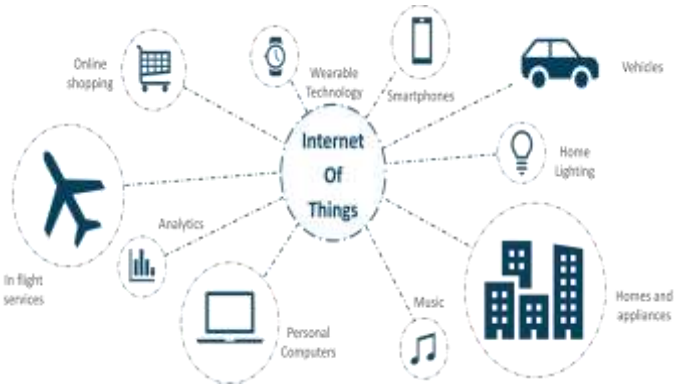

FIGURE 2: INTERNET OF THINGS

The year 2019 had excessed rain fall in most of the parts of India. The accumulation and storage of rain water for reuse is important reconsidering the unpredictable climate conditions.

Rain water harvesting is tremendously required especially considering the fact that the ground water level is depleting due to excess groundwater and climatic conditions are fluctuating. RWH can definitely help to relieve these impacts.

Catching the water can help:

- Revive nearby springs
- Lessen urban flooding
- Guarantee water accessibility in water-scant zones
- Recently Pune Municipal Corporation's standing advisory group affirmed the urban body's proposition to advance downpour water gathering, particularly in old lodging social orders, by giving them money related guide.
- In addition to this, PMC is also giving 5% rebate in Property tax on implementation of RWH for housing societies.
- However there is a need to have a system in place to assess the effects of RWH. This will help PMC to understand the adaption and impact of RWH in Pune region.[4]

Following are some of the objectives of the Research Study which is being undertaken are:

- To study of the existing RWH systems
- To assess status of existing implementations of RWH systems in Pune city
- To design suitable interface using IoT sensors to monitor RWH systems in the drought affected region.
- To define, monitor and measure the KPIs of RWH systems
- To collect and save all information for further Data Analysis which will help PMC authorities
- To suggest the best suitable design of RWH system for domestic, agricultural and industrial use.

Proposed design for Smart Rainwater Harvesting System (SRWHS) using IoT Smart Kit for Monitoring and Performance Measurement:

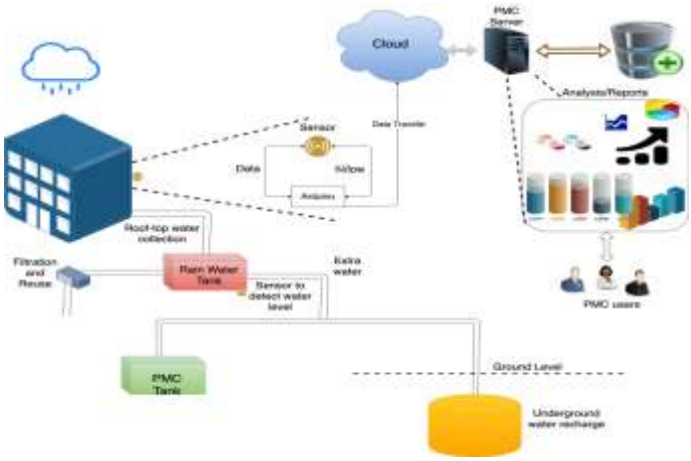

FIGURE 3: PROPOSED DESIGN FOR SRWHS

V. CONCLUSION

The output of this study will be generated through IoT Based Smart Kit Management for RWH/groundwater recharge structure, monitoring and performance measurement, which would certainly be very useful for decision makers, Municipal Corporations, Residents and Water Resources Planers in the Pune city which would certainly be very useful for decision makers, Municipal Corporations, Residents and Water Resources Planers in the Pune city to make appropriate planning and management of water environment now and for the future. The results may also help planners manage rain-water in similar regions in the city through SRWHS. Moreover, greater practicality studies can be led for different methods utilized in water collecting to recognize site-explicit perceptions, which broaden groundwater revive from catchment zones, for example, the development of little dams, limits, soil pits, energize wells, and tanks. In addition, different examinations are additionally required for handling natural difficulties. The effect of these examination study could be increasingly critical in the high-thickness territory. Hence, catching water spillover may expand water accessibility and lessen water request.The IoT based SRWHS will be designed using using a sensor based information system and remote sensing.

Expanding water request, which can't be fulfilled without the advancement of new resources.Available assets, not situated in the regions of popularity, which can bring about improper water dispersion over enormous separations. This needs to improve the exhibition of farming frameworks through progressing endeavors to create and apply new innovations and adjust them to accomplish independence.

In any case, an effective usage of SRWHS strategies in the city can give a way to diminishing guaranteeing to satisfy the need and flexibly hole. The execution of RWH strategies has just delivered an overall mindfulness among individuals but it needs to be taken further for its effective implementations in the city especially drought affected areas. It will provide local innovations, creations, and strategies for SRWHS.

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